Foundations of Modern Networking

SDN, NFV, QoE, IoT, and Cloud

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Chapter 1

Elements of Modern Networking

Cloud Storage

- Can be thought of as a subset of cloud computing
- Consists of database storage and database applications hosted remotely on cloud servers
- Enables small businesses and individual users to take advantage of data storage that scales with their needs and to take advantage of a variety of database applications without having to buy, maintain, and manage the storage assets

Internet of Things

- Term that refers to the expanding interconnection of smart devices, ranging from appliances to tiny sensors
- A dominant theme is the embedding of short-range mobile transceivers into a wide array of gadgets and everyday items, enabling new forms of communication between people and things and between things themselves
- Primarily driven by deeply embedded devices
- These devices are
  - low-bandwidth,
  - low-repetition data-capture
  - low-bandwidth data-usage appliances that communicate with each other and provide data via user interfaces

Evolution

- With reference to the end systems supported, the Internet has gone through roughly four generations of deployment culminating in the IoT:

Information technology (IT)

- PCs, servers, routers, firewalls, and so on, bought as IT devices by enterprise IT people, primarily using wired connectivity

Operation technology (OT)

- Machines/appliances with embedded IT built by non-IT companies, such as medical machinery, SCADA, process control, and kiosks, bought as appliances by enterprise OT people and primarily using wired connectivity

Personal technology

- Smartphones, tablets, and ebook readers bought as IT devices by consumers exclusively using wireless connectivity and often multiple forms of wireless connectivity

Sensor/actuator technology

- Single-purpose devices bought by consumers, IT, and OT people exclusively using wireless connectivity, generally of a single form, as part of larger systems

Layers of the Internet of Things

- Sensors and actuators
  - These are the “things”
  - Sensors observe their environment and report back quantitative measurements
  - Actuators operate on their environment
- Connectivity
  - A device may connect via either a wireless or wired link into a network to send collected data to the appropriate data center (sensor) or receive operational commands from a controller site (actuator)
- Capacity
  - The network supporting the devices must be able to handle a potentially huge flow of data
- Storage
  - There needs to be a large storage facility to store and maintain backups of all the collected data
- Data analytics
  - For large collections of devices, “big data” is generated, requiring a data analytics capability to process the data flow

Network Convergence

- Refers to the merger of previously distinct telephony and information technologies and markets
- You can think of this convergence in terms of a three-layer model of enterprise communications:
  - Application convergence
    - These are seen by the end users of a business
    - Convergence integrates communications applications with business applications
  - Enterprise services
    - At this level, the manager deals with the information network in terms of the services that must be available to ensure that users can take full advantage of the applications that they use
  - Infrastructure
    - The network and communications infrastructure consists of the communication links, LANs, WANs, and Internet connections available to the enterprise
    - A key aspect of convergence at this level is the ability to carry voice, image, and video over networks that were originally designed to carry data traffic

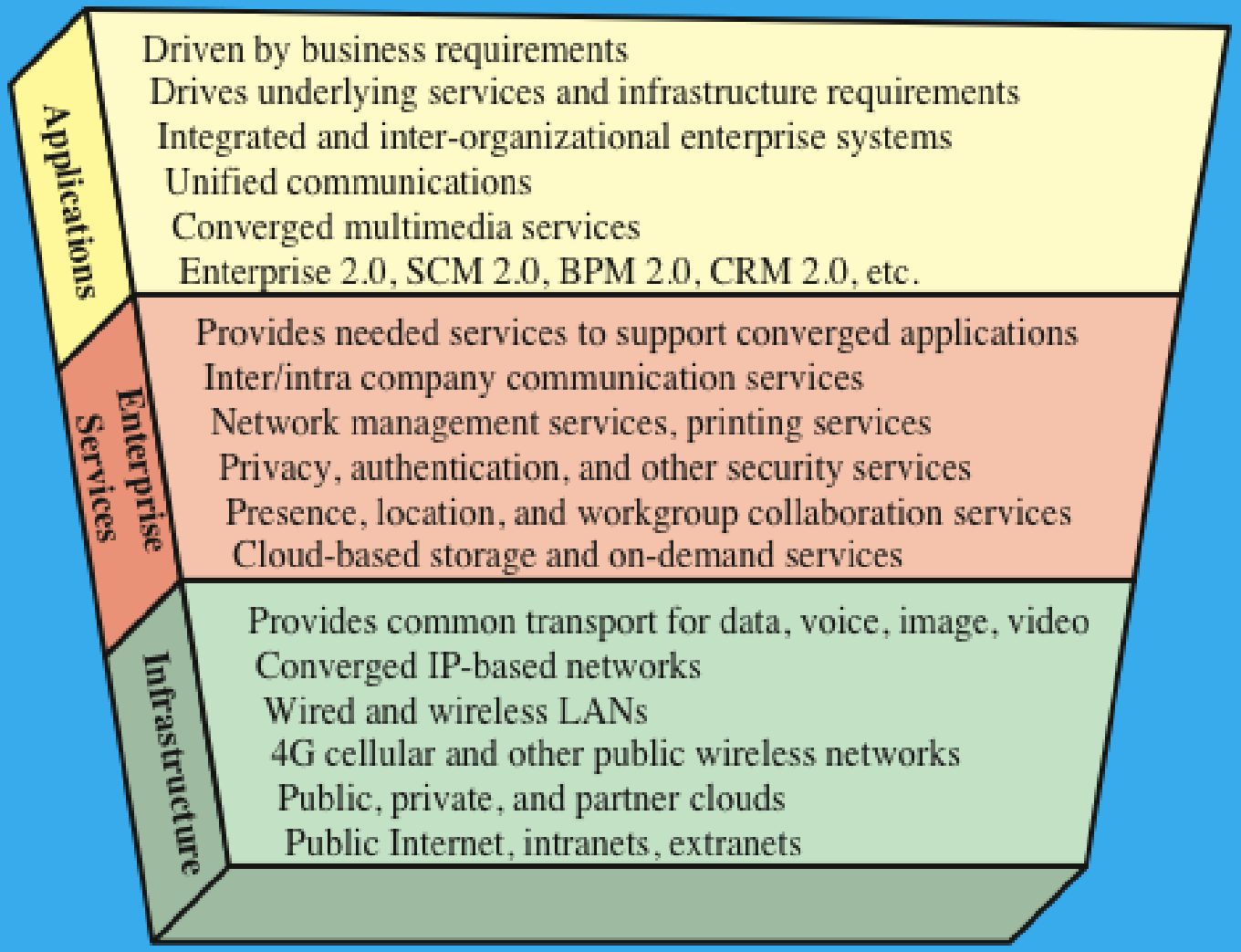

Figure 1.8 Business-Driven Convergence

Unified Communications (UC)

- Focuses on the integration of real-time communication services to optimize business processes
- IP is the cornerstone on which UC systems are built
- Key elements of UC include:
  - UC systems typically provide a unified user interface and consistent user experience across multiple devices and media
  - UC merges real-time communications services with non-real-time services and business process applications